

The Three States of Matter

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VITAL INFORMATION

Subject(s)	Science
Topic or Unit of Study	What is matter? The three states of matter
Grade/Level	Grade 4, Grade 5
Objective	Children will be able to explain what matter is and will also be able to identify the three states of matter. Students will also be able to identify what factors change water from solid to liquid to gas.
Summary	Solid, liquid, and gas are the three states of matter. Children will be given the definition of solid, the definition of liquid, and the definition of gas. Children will be given an ice cube and asked if they know what the ice cube is made of. When the children answer, "water" the teacher explains that ice cubes are water in its solid form. While discussing water in its solid form, the ice cubes will be melting. The teacher will ask the students if they think this is still water. When they answer yes, they will be told that the melting ice is water in its liquid form. The teacher should have a beaker on a side counter of boiling water. Each child will be handed a balloon and will be told to blow up the balloon. The beaker demonstrates steam, which is the gas state of matter. Boiling water is turning water from liquid to gas. The balloons allow students to see gas in a solid form. Students should then be asked how to get water to change states of matter. The answer is to change the water's temperature, freezing or boiling. Students will proceed to experiment with baking soda and vinegar in a soda bottle with the balloon over the top. This will show what happens when a solid and a liquid is mixed together to form a gas. The balloon over the top will blow up.

IMPLEMENTATION

Learning Context	The general context of the unit on the three states of matter is scientific inquiry through hands-on experience. Students should also be learning about the scientific method as well as the relationship between the change in temperature and matter. Prior to this experiment, students should have a basic understanding of the scientific method and experimentation. After this lesson is performed, more lessons using the scientific method can be performed. Students can create their own hypothesis about the mixtures of various chemicals (safe to have in the classroom).
Task Analysis/Procedure	Students should be given the definition of solid, the definition of liquid, and the definition of gas: the three states of matter. Children will each be given an ice cube and asked what the ice cube is made of. The answer is water. The teacher will explain that ice is water in its solid form. As the ice melts, the teacher will then explain that the melting ice is water in its liquid form. The teacher will have a beaker with boiling water on a side counter and show the children that the steam

	<p>from boiling water is water in its gas form. The students will then be asked what needs to be done to change a state of matter. The answer is to change the temperature, either to boiling or to freezing. When water freezes, it creates a solid. When water is boiled, it creates a gas. Children will be given a balloon to blow up, which is gas in a solid form. Children will then each be given a plastic soda bottle and a pre-measured amount of baking soda, along with a pre-measured amount of vinegar. Children will be instructed to pour both the baking soda and the vinegar into the soda bottle and place the balloon over the mouth of the bottle. The chemical reaction between the liquid vinegar and the solid baking soda will produce a gas, which will blow up the balloon, so the children will be able to see all three forms of matter together and what happens when you mix certain forms of matter together. After the experiment, the children will be asked to write a summary of how they saw matter change and what the definitions of each state of matter is. The children will also be encouraged to draw pictures of the experiment and discuss with their neighbors the effects of changing the temperature of solids, liquids, or gas. When the experiment is finished, children should be allowed to use the internet and ask questions about other chemical reactions and the effects of mixing various forms of matter together.</p>
Collaboration	Students will work collaboratively & individually. Students will work in groups of 2.
Time Allotment	1 class periods. 1 Hr per class.
Author's Comments	Make sure the baking soda and vinegar are pre-measured, as to keep children from experimenting with various amounts of the chemicals. Make sure the beaker and burner are set up before the class begins and have the water already boiling by the time the students are instructed to examine the steam.

MATERIALS AND RESOURCES

Instructional Materials (handouts, etc.)	Students will each need a balloon for the experiment, an empty soda bottle, a pre-measured amount of vinegar and baking soda. Students will need paper to write a brief summary of the experiment as well as a description of the three states of matter. Children will also need colored pencils or markers to draw pictures of the experiment, what happens when some kinds of solids and some kinds of liquids are mixed together?
Resources	<ul style="list-style-type: none"> Materials and resources: Balloon, beaker and burner, empty soda bottles, coloring utensils, paper, ice cubes, vinegar, and baking soda. Technology resources: Firefox, PowerPoint, Word The number of computers required is 1 per 2 students. Students Familiarity with Software Tool: Students will have been shown other slideshows made using powerpoint, as well as having made their own powerpoint presentations. In fifth grade, students will have developed typing skills and the ability to use microsoft word. The internet will be used to look up the definitions and continue on with the unit if children have questions as to what happens when other chemicals or states of matter are mixed together.

STANDARDS & ASSESSMENT

Standards

Display: ☐ Collapse All ☒ Expand All

▼OR- Oregon Standards

▼Subject: Science

▼Grade: Fifth Grade

▼Content Standard:

5.3 Scientific Inquiry: Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

Performance Standard:

5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.

5-E Lesson Plan
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Title	Falling Objects
Grade level	Fifth
State standards	Performance Standard: 5.1E.1 Describe the Sun-Earth-Moon system. Focus: Gravity on Earth
Engage	The teacher will pull up a chair and stand on it at the front of the classroom with a heavy book (a large dictionary, a thick encyclopedia, etc.). The teacher will drop the book to the floor, which will make a loud noise. When the students look at the teacher, the teacher will say, "Why did the book fall down and not up?" The teacher will explain the concept of gravity to the students after listening to their answers. The teacher will then ask, "If I drop a tennis ball and a crumpled up ball of paper from the same height, which object will hit the ground first?" "Do heavier objects fall faster than lighter objects?"
Explore	Students will work in groups of three for this experiment. Each group will be given a tennis ball and a crumpled up ball of paper about the same size as a tennis ball. Students will need to measure the distance from the floor to the dropping point. Students can use the top of a desk as the first dropping point and measure a foot higher and so on. The objects must be dropped at the same time during each try of the experiment. Students must chart the height at which they dropped the objects and which object hit the ground first. If the experiment is conducted accurately, both objects will hit the ground at the same time. Each group member must take two turns dropping the objects, recording the data, and watching to see which hits the ground first.
Explain	Gravity is the centrifugal force that pulls objects to the core of the Earth. "Because of gravity, if you drop something, it falls down, instead of up" (The Space Place, 2011). "In 1589, a young scientist and mathematician named Galileo Galilei conducted a simple experiment. Galileo dropped two iron balls of different masses from great height to see which ball hit the ground first" (Science Buddies, 2011). Before Galileo attempted this experiment, a famous philosopher named Aristotle who lived 2000 years before, suggested that when two objects were dropped from the same height, the heavier object would hit the ground first. Galileo proved that Aristotle's theory of gravity was incorrect. Objects dropped at the same height, regardless of weight or mass will always hit the ground at the same time.

Elaborate	Gravity is what makes pieces of matter clump together into planets, moons, and stars. Gravity is what makes the planets orbit the stars. Earth orbits one giant star, a star we call the Sun. Gravity is also what makes stars clump together to form galaxies (Space Place, 2011). Gravity exists everywhere in the universe. The reason we feel the Earth's gravity is because the Earth is massive and this is the planet we, as humans, are the closest to. What would happen if there was no gravity on planet Earth? Which has a higher gravitational pull, the Earth or the moon?
Evaluate	Each group of students must present their findings to the rest of the class and explain what they have discovered about gravity and dropping objects at the same distance from the ground at the same time. Each group must be prepared to answer questions and defend their answers. If students did not get the results that objects dropped at the same time will hit the floor at the same time regardless of mass, students must offer suggestions as to why not and will be asked how they can modify the experiment to ensure they get different answers next time.
Differentiating Instruction	All students will be required to participate in this experiment. Gifted students could be asked to use the tennis ball, a ball of paper and then a book and a ball of paper, a book and a tennis ball, etc. Students could be asked to write their findings in an essay instead of presenting them to the class. Provisions for students with special needs will be made in accordance with the particular student's IEP. Vocabulary words such as "Gravity" and "Force" and "Galaxy" and "Planet" should be written on the board with definitions prior to beginning the experiment.
NSTA safety standards that apply to this lesson	During this activity, students must behave responsibly. Students may not use the objects to be tested as anything other than what their intended purpose is for this experiment. If students are going to measure from a height that requires the students to stand higher than the ground, they must use caution and they may not stand higher than their desks.

References

Science Buddies. (2011). What Goes Up, Must Come Down. Retrieved from

http://www.sciencebuddies.org/science-fair-projects/project_ideas/Phys_p015.shtml

The Space Place. (2011, May 31). What is Gravity Really? Retrieved from

<http://spaceplace.nasa.gov/what-is-gravity/>

